Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

Nuclear Safety

AECB Annual Report

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Cette publication est également disponible en français.

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Canadian Nuclear Safety Commission
Commission canadienne de sûreté nucléaire

The Honourable Ralph Goodale
Minister of Natural Resources Canada
Ottawa, Ontario

Sir:

I have the honour to present to you the attached Annual Report of the Atomic Energy Control Board for the year ending March 31, 2000. This report has been prepared and is submitted in accordance with the *Atomic Energy Control Act*, section 21(1).

With the coming into force of the *Nuclear Safety and Control Act* on May 31, 2000, the Canadian Nuclear Safety Commission is pleased to publish the final annual report of the Atomic Energy Control Board.

On behalf of the Board,

Agnes J. Bishop, M.D.
President

Canada

FOREWORD

With the coming into force of the *Nuclear Safety and Control Act* on May 31, 2000, the Canadian Nuclear Safety Commission (CNSC) is responsible for publishing the fifty-third annual report of the Atomic Energy Control Board (AECB), for the fiscal year ending March 31, 2000.

Additional information on the AECB and the CNSC may be found in the Estimates of the Government of Canada, specifically the AECB's 1998-1999 Performance Report and its 2000-2001 Report on Plans and Priorities.

On behalf of the AECB, the CNSC acknowledges the assistance received from federal and provincial departments and agencies by their participation in matters relating to the Board's regulatory activities. It also acknowledges the advice given by experts in industry, academia and research institutions through AECB advisory committees and other ad hoc committees.

The CNSC also recognizes the many comments received from the public on regulatory and licensing issues. Public participation in the licensing process provides valuable input to the decision-making process.

PRESIDENT'S MESSAGE

As I reflect upon the year behind us and look forward to the year ahead, two themes come to mind: change and challenge.

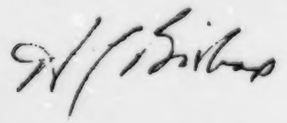
During the year 1999-2000, the AECB continued to prepare for the coming into force of the *Nuclear Safety and Control Act* and to develop the new regulations and other essential regulatory documents that will support it. Significant input was received from the industry, several government departments and agencies, and the public to assist us in this process. Under the new legislation, the Canadian Nuclear Safety Commission will have a firmer and modern legislative basis to carry out its various responsibilities. Our staff are to be commended for how well they have responded to the need to prepare for the transition to the new regulatory regime while maintaining their normal regulatory activities.

It is not possible to review the past year without mentioning the safe passage to the year 2000. The absence of any significant incidents in the nuclear industry related to the Y2K problem is largely the result of the extensive preparations that the AECB required its licensees to carry out.

Over the coming years, Canada's nuclear regulator will continue to be challenged by a variety of environmental, economic and social issues. In addition to ensuring the effective implementation of the new Act and regulations, the regulator will need to pay close attention to the impacts on safety of the significant changes occurring in the industry, such as market deregulation and possible privatization of the electrical power industry, and the intended return to service of nuclear power facilities that have been shut down for several years. It will also have to continue to develop its enhanced environmental protection program.

Other challenges include the need to improve the harmonization of regulatory activities with other appropriate federal and provincial bodies, and to meet the higher expectations of the Canadian public in terms of information and opportunities to contribute to the decision-making process.

On a personal front, I will be retiring at the end of year 2000. It has been my privilege over the past nine years to have served this organization both as a board member and as its president and chief executive officer. I would like to thank my fellow board members and the staff of the AECB for their support, expertise and professionalism. I offer best wishes for the future, and continued success in managing the challenges that lie ahead.



Agnes J. Bishop, M.D.

Section I
The Way We Operate

OUR AUTHORITY

The Atomic Energy Control Board (AECB) was established by Parliament in 1946, under the *Atomic Energy Control Act*. It is a departmental corporation, named in Schedule II of the *Financial Administration Act*. The AECB reports to Parliament through the Minister of Natural Resources Canada.

OUR MISSION

The AECB's mission is to regulate the use of nuclear energy and materials to protect health, safety, security and the environment and to respect Canada's international commitments on the peaceful use of nuclear energy.

The AECB achieves its mission in Canada through regulations and a comprehensive licensing system. Licensing is administered so that the responsibilities of federal and provincial government departments are taken into account in such areas as health, environment, transport and labour. While the activities of the AECB are funded by Parliamentary appropriations, regulatory costs are recovered through licence fees remitted to the federal government.

The AECB plays a major role on the nuclear scene world-wide by working to ensure compliance with Canada's international treaty obligations on the peaceful use of nuclear energy and the non-proliferation of nuclear weapons. Our international commitments are met by working closely with international agencies and by cooperating with countries through bilateral agreements to ensure that appropriate regulatory controls over nuclear materials and facilities are in place.

OUR MANDATE

With the coming into force of the *Nuclear Safety and Control Act* on May 31, 2000, the AECB became the Canadian Nuclear Safety Commission (CNSC). The CNSC's mandate includes:

- regulation of the development, production and use of nuclear energy in Canada;
- regulation of the production, possession, use and transport of nuclear substances, and the production, possession and use of prescribed equipment and substances;
- implementation of measures respecting international control of the use of nuclear energy and nuclear substances, including measures respecting the non-proliferation of nuclear weapons; and
- dissemination of scientific, technical and regulatory information concerning the activities of the AECB.

OUR ORGANIZATION

The Board

The AECB is a five-member corporate body, of whom four members are appointed by the Governor in Council and the fifth is an *ex officio* member. The President is the only full-time member, and is also the Chief Executive Officer of the AECB. The Board meets an average of 10 times a year to consider licence applications and other submissions.

Members of the Board

The composition of the current Board is as follows:

Dr. Agnes J. Bishop
President, Atomic Energy Control Board, Ottawa, ON

Dr. Arthur J. Carty
President, National Research Council of Canada, Ottawa, ON

Dr. Christopher R. Barnes
Director of the Centre for Earth and Ocean Research and of the School of Earth and Ocean Sciences, University of Victoria, Victoria, BC

Dr. Yves M. Giroux
Assistant to the Rector, Laval University, Québec, QC

Mr. Alan R. Graham
Rexton, NB

The Board licenses nuclear- related activities in Canada, establishes legally-binding regulations, and sets regulatory policy direction on matters relating to health, safety, security and environmental issues affecting the Canadian nuclear industry. While the Board hears applications for licences for major nuclear facilities, it delegates responsibility for licensing matters in a number of areas to its supporting staff.

Individuals and organizations are welcome to attend meetings and encouraged to make submissions and appearances before the Board. The AECB takes into account the views, concerns and opinions of interested parties and intervenors when establishing regulatory policy, making licensing decisions and implementing programs.

Advisory Committees

The Board receives advice from two advisory committees plus a medical liaison officer, who report independently to the President.

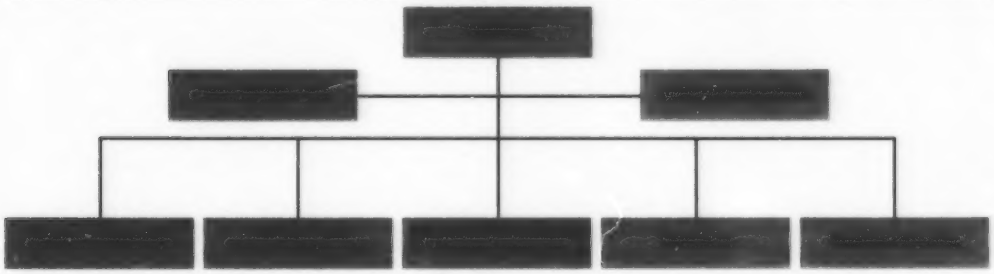
The Advisory Committee on Radiological Protection (ACRP) and the Advisory Committee on Nuclear Safety (ACNS) are independent committees made up of technical experts from outside the AECB. The ACRP and ACNS provide advice on generic issues and are not involved with licensing activities. During the reporting period, the committees met eight times in plenary session. As well, committee working groups met six times. The membership of the two committees as of March 31, 2000, can be found in Annexes I and II. A full-time Medical Liaison Officer from Health Canada also provides ongoing assistance to the AECB.

Effective September 1, 1999, the former Group of Medical Advisors (GMA) was dissolved, and its advisory functions incorporated into the ACRP. The GMA was composed of senior medical professionals nominated by the provinces, Atomic Energy of Canada Limited, the Department of National Defence and Health Canada. The revised mandate of the ACRP ensures continued representation by the medical community. During the period from April to September 1999, joint working groups of the advisory committees and the former Group of Medical Advisors met a total of three times.

Legal Services Unit
The Board receives legal advice from a Legal Services Unit staffed by Department of Justice lawyers.

AECB Staff
AECB staff are organized into five directorates that report to the President in her capacity as AECB's Chief Executive Officer.

The AECB at a glance



- The **Directorate of Reactor Regulation** regulates the operation of all nuclear power plants in Canada. It develops safety standards and licensing conditions related to the construction and operation of power reactors, assesses licence applications, prepares licensing recommendations to the Board, and is responsible for compliance activities related to the operation of power reactors.
- The **Directorate of Fuel Cycle and Materials Regulation** regulates uranium mining and milling, and the subsequent refining and processing into fuel. It also regulates research facilities, medical and industrial particle accelerators, radioisotope production and use, decommissioning activities, the management of radioactive waste, and packaging for the transport of radioactive materials. The directorate assesses licence applications, prepares licensing recommendations to the Board and is responsible for compliance activities.
- The **Directorate of Environmental and Human Performance Assessment** assesses the performance of licensees in the areas of radiation and environmental protection, quality assurance, personnel qualification and assessment, training and human factors. It is responsible for AECB obligations related to the *Canadian Environmental Assessment Act*, for the investigation of accidents and other significant events, and for research programs and development of standards. The directorate provides technical training for AECB personnel as well as foreign staff under cooperation agreements.
- The **Secretariat** provides administrative support to the Board and its advisory committees and working groups. It provides services in the areas of external relations, corporate documents, public communications, and corporate planning and coordination. The Secretariat is also responsible for implementation of requirements to fulfil Canada's international non-proliferation, safeguards and security obligations, and for AECB responsibilities under the *Access to Information Act* and the *Privacy Act*.
- The **Directorate of Corporate Services** manages the AECB's human, information, financial and physical resources. It also administers its security and conflict of interest programs.

The Board

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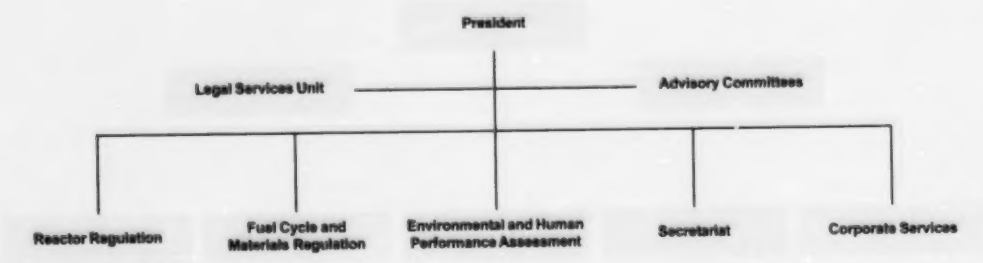

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The Audit and Evaluation Group, reporting directly to the President, is responsible for examining corporate management accountability and program performance issues, and for making recommendations for improvement.

At year-end, the AECB employed 402 staff, 343 in Ottawa at the AECB headquarters, and 25 at regional offices in Saskatoon, Saskatchewan, Calgary, Alberta, Mississauga, Ontario and Laval, Quebec. Thirty-four staff members worked at the power reactor sites.

To support its compliance monitoring program, the AECB also maintains a laboratory in Ottawa that carries out analyses of samples taken during compliance or environmental inspections of licensees. The laboratory also assists other federal agencies with radiation measurements and works with international organizations.

OUR REGULATORY REGIME

The *Atomic Energy Control Act* and its regulations impose requirements on persons who produce or use nuclear energy, or who produce, export, import, transport, refine, possess, own, use or sell prescribed substances and equipment, as well as on others who are identified in the regulations or in licences.

The AECB regulates:

- power and research reactors
- nuclear research and test establishments
- uranium mines and mills
- uranium refining and conversion facilities
- fuel fabrication facilities
- heavy water production plants
- radioisotope production and processing facilities
- particle accelerators
- radioactive waste management facilities
- prescribed substances and items
- radioisotopes

The AECB's legal framework includes law and supporting regulations. Regulatory documents such as policies, standards, guides, notices, procedures and information documents also support and provide additional information on the AECB's requirements. Regulatory standards are set by the AECB, and where appropriate, are drawn upon standards or codes developed by other organizations such as the Canadian Standards Association and the American Society of Mechanical Engineers, or provincial authorities.

Regulatory control is achieved by setting regulatory requirements and issuing licences containing conditions that must be met. Requirements for licensing vary with the type of facility or regulated activity. When applying for a licence, applicants are required to identify potential risks and consequences under both normal use and accident conditions, and to establish specific engineering measures and operating practices to mitigate these consequences to tolerable levels.

Once licences are issued for activities involving the use of nuclear energy or nuclear substances, AECB inspectors are active in monitoring operations to verify that they comply with regulations and licence conditions.

The AECB regulatory regime also includes the control of nuclear substances and other nuclear items relating to the non-proliferation of nuclear weapons. This is carried out through licence conditions requiring the careful control and accounting of prescribed substances, by controlling imports and exports of prescribed substances and equipment and by ensuring that specific obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons* are fulfilled.

Regulatory Harmonization

The AECB is committed to streamlining the regulatory regime, minimizing the regulatory burden and reducing administrative costs while ensuring an effective and efficient system.

At the federal level, the AECB is working with Health Canada, Natural Resources Canada, Transport Canada, Environment Canada, Human Resources Development Canada, Fisheries and Oceans Canada and the Department of Foreign Affairs and International Trade to increase cooperation on regulatory issues that impact on or originate with the nuclear industry. The reduction of regulatory overlap and duplication with provincial regulators is equally important. To this end, during 1999-2000, the AECB continued discussions with officials from the Government of Saskatchewan to promote harmonization of the regulatory regime for uranium mines and mills in that province.

Section II
Putting Nuclear Safety First

The Atomic Energy Control Board (AECB) regulates the nuclear industry in Canada for the purpose of preventing undue risk to health, safety, security and the environment. The AECB's responsibilities also include working to achieve compliance with Canada's commitments related to international security, safeguards and non-proliferation of nuclear weapons.

PROTECTING PEOPLE AND THE ENVIRONMENT

Radiation Protection

The *Atomic Energy Control Regulations* prescribe dose limits for the general public and workers who may be exposed to ionizing radiation that results from the use and possession of radioactive materials and from the operation of nuclear facilities. The limits specified are based on scientific evidence, including data collected and analysed over many years, and the recommendations of international bodies. The dose limits are based on expert judgment that is derived not only from the scientific evidence, but also from knowledge of the level of risk that workers in other industries consider to be safe, and the level of risk the public is willing to tolerate in their normal life.

As with most nations having radiation-related activities, Canadian dose limits are based on the recommendations of the International Commission on Radiological Protection (ICRP). Under the *Nuclear Safety and Control Act*, radiation protection regulations are consistent with the latest ICRP recommendations.

For radiation protection purposes, the AECB requires licensees to conduct their activities in accordance with the principle that all doses should be kept as low as reasonably achievable, social and economic factors being taken into account (the ALARA principle). In practice, application of the ALARA principle ensures that doses actually received are much lower than the prescribed limits.

The AECB monitors the annual doses received by workers exposed to ionizing radiation in licensed facilities. This work is carried out with Health Canada, which is responsible for collecting dosimetry data. In this report, information on annual doses for workers can be found within each licensing section. Additional information on dose statistics may be found in Health Canada's annual report on Occupational Radiation Exposures in Canada.

The AECB also evaluates the radiation doses to members of the public who live in the vicinity of nuclear power stations and other nuclear facilities. In 1999, no member of the public was exposed to a dose in excess of the dose limit of 5 mSv per year. Information on doses to members of the public living near nuclear power stations is reported by the AECB in a quarterly publication called Radiation Index. In 1999-2000, the Radiation Index informed the public about the radiation levels around the Pickering, Darlington, Bruce and Point Lepreau licensed facilities.

Doses to members of the public living near other major facilities ranged from 0.0025 mSv (or 0.05% of the annual public dose limit) to 0.15 mSv (3% of the annual public dose limit) — all well below dose limits.

Environmental Protection

A considerable amount of effort is spent by the AECB on regulating the environmental performance of nuclear facilities to verify that the licensed activities do not pose undue risk to the environment. Much of this effort involves the review of predicted environmental effects, proposed environmental protection measures, and environmental monitoring data gathered at licensed facilities. In 1999-2000, the AECB conducted four on-site evaluations of licensee environmental monitoring programs and assessed the environmental performance of two nuclear power stations, two uranium refineries and two uranium mines.

During 1999-2000, the AECB continued the implementation of a corporate Environmental Information Management System, with the intent of providing a secure database of environmental information for use in monitoring the environmental compliance of licensee activities. The database will be continuously updated with the most recent environmental data from the major licensees, and will give AECB staff the capability to review and report on the environmental performance of facilities.

The *Canadian Environmental Assessment Act* (CEAA) came into effect in January 1995. It places a range of obligations on the AECB relating to the conduct of environmental assessments for projects that it regulates.

During the reporting period, a total of 15 environmental assessments were in progress. Four were completed, and eleven were ongoing, including the environmental assessment associated with the application to restart Ontario Power Generation Inc.'s Pickering A nuclear power station, which has been laid up since the end of 1997.

Ensuring Workplace Competence

The AECB maintains a staff of specialists whose function it is to obtain assurance that specified workers at nuclear power plants and at research and test reactors are competent to perform their duties. This assurance is obtained through the evaluation of licensees' training programs, the evaluation of tests administered by the licensees, and written and simulator-based examinations given by the AECB for key operations personnel.

During the reporting period, significant effort was directed to the evaluation of training programs at Ontario Power Generation Inc., Hydro-Québec and New Brunswick Power. In addition to testing of candidates for supervisor and control-room operator at the nuclear power plants, the AECB also held exams for manager, operations and reactor operator candidates for the new MAPLE-1 isotope reactor facility at AECL's Chalk River Laboratories in Chalk River, Ontario.

During 1999-2000, the AECB held examinations for candidates from five of the seven nuclear power plants, for positions as shift supervisor and control-room operator. A total of 26 were formally authorized by the AECB for these positions.

On January 1, 1999, the AECB suspended its supplementary examination for shift supervisor candidates at all nuclear power plants because of a number of inadequacies in licensees' training programs. This examination will resume at individual plants when licensees' training standards have been improved.

After several years of discussion with licensees, the AECB amended all its authorizations for shift supervisors, shift operating supervisors and control-room operators at nuclear power plants, and for operations personnel at the McMaster University reactor. The amendment limits the validity of these authorizations to five years, beginning March 1, 2000. Persons working in licensed positions will need to be recertified to confirm that they are maintaining their competence and expertise.

During the reporting period, AECB staff reviewed and provided comments on a joint proposal by the three nuclear power plant licensees concerning a standard for requalification testing of their key operations personnel. The objective is to develop a standard acceptable to all utilities and the AECB.

Physical Security

The AECB monitors the development and implementation by licensees of effective physical protection measures for Canadian nuclear facilities and nuclear materials, in accordance with AECB regulations.

During the reporting period, AECB staff conducted four security inspections at Canadian nuclear power reactors and at five waste-management areas to verify compliance. AECB staff also monitored two security exercises conducted by licensees and their respective off-site response forces. These exercises evaluated the validity of licensees' contingency plans and the licensees' competence to adequately handle emergencies initiated by a security incident.

Emergency Preparedness

The AECB must be prepared for emergencies involving its licensees and for international nuclear emergencies. Emergency preparedness involves cooperation and planning with licensees, provincial and federal government agencies, and international organizations.

The AECB operates a duty officer program by which anyone can report incidents involving the actual or potential release of radioactive materials to the environment, or seek emergency information, advice or assistance. The duty officer is available on a 24-hour basis and is the first point of contact in case of emergencies. When an incident has the potential for significant consequences, the AECB duty officer plays a key role in activating the AECB emergency response.

The AECB's role during an emergency is to monitor the response of the licensee, evaluate the emergency response actions, provide technical advice and regulatory approval when required and inform the government and the public on its assessment of the situation. For events that have an off-site impact, the municipality or province has primary authority for the local emergency response.

For emergencies that have significant consequences and require the involvement of several levels of government, the Federal Nuclear Emergency Plan (FNEP), which is led by Health Canada, serves to coordinate the response of federal departments and provincial emergency response teams.

A key element of the AECB's emergency preparedness is its Emergency Response Plan and participation in simulated incidents to check its emergency response capability. During the reporting period, staff participated in three AECB/licensee emergency exercises, which were based on simulated on-site events. One of these exercises, CANATEX-3 (Canadian National Exercise-3) was part of an international series of nuclear emergency exercises. In November 1999, the President of the AECB approved a revised Emergency Response Plan, which incorporated lessons learned from several simulated incidents.

In 1999-2000, AECB duty officers received calls for 206 separate occurrences, of which 72 (35%) were related to actual or potential incidents. The remaining calls related to simulated incidents (47), to AECB administrative requirements (21), and to non-emergency matters (66). The majority of the 72 "actual or potential" incidents were events that licensees were required to report in order to comply with regulatory requirements. These ranged from notification of an earthquake being recorded at a nuclear generating station to reports of damage to road construction equipment that contained radioactive sources. These incidents are followed up and usually have no radiological consequence.

Nuclear Liability

The AECB is also responsible for designating nuclear installations under the *Nuclear Liability Act* and prescribing the amount of basic insurance to be maintained by the operator. The *Nuclear Liability Act*, which was passed by Parliament in 1970, provides compensation on a no-fault basis to third parties who suffer injuries or damages as a result of a nuclear incident. The National Insurance Association of Canada provides the basic insurance to operators of nuclear facilities.

During the reporting period, the AECB continued to assist Natural Resources Canada, which has lead responsibility for the *Nuclear Liability Act*, in its review of the Act. This review is consistent with renewed international interest and efforts toward improved legislation and international agreements in the area of third-party liability.

LICENSING AND COMPLIANCE

Power Reactors

As of March 31, 2000, there were 22 power reactors licensed by the AECB. In Ontario, there are four Bruce A and four Bruce B reactors near Kincardine, four Pickering A and four Pickering B reactors in the Ajax-Pickering area, and four reactors at Darlington, near Bowmanville. There is one reactor at Gentilly, near Trois-Rivières, Quebec, and one at Point Lepreau, near Saint John, New Brunswick. Of the 22 licensed reactors, eight have produced little or no power since 1998. The four reactors at Pickering A and the four at Bruce A were laid up in late-1997/early-1998 to allow Ontario Hydro, predecessor to Ontario Power Generation Inc. (OPG), to improve the operation of its remaining power plants. These reactors remain shut down, in an approved state, and will not be restarted until authorized by the AECB.

The AECB also licenses a tritium-removal facility located at the Darlington site. This facility is designed to remove tritium from the heavy water used in reactors to reduce the hazards to the operating staff and the possible release of radioactive material to the atmosphere.

During the reporting period, the AECB approved the licence renewal for the Bruce B reactors, for a two-year term expiring March 31, 2002. OPG is required, as a condition of its licence renewal, to report every six months to the AECB on station operations.

Other licensing actions that occurred in 1999-2000 reflected developments in electricity market restructuring. The provincial utility, Ontario Hydro, was broken into a number of separate companies on April 1, 1999. The Ontario Hydro generating facilities, including the nuclear generating stations and associated staff, were transferred to the newly-created OPG. Since AECB licences cannot be transferred, OPG applied for and received operating licences for the Pickering, Darlington and Bruce nuclear generating stations.

On November 24, 1999, OPG applied to the AECB to return the four Pickering A reactors to power operation. AECB staff determined that an environmental assessment under the *Canadian Environmental Assessment Act* (CEAA) was needed prior to the Board considering the application. The assessment included opportunities for public review of the draft scope of assessment document, which was released for public comment on November 2, 1999. The final scope was published on January 31, 2000, and the draft assessment report was released for public comment in April 2000.

As part of the licensing and compliance program, AECB staff continually assessed every station's performance against codes, standards, legal requirements, and specific conditions of operating licences. The AECB's inspection program is the primary activity by which AECB staff verify licensees' compliance with the regulatory requirements. The program includes 31 different inspections or audits, each with a specified frequency. Staff also monitor licensees' actions to verify that findings from previous inspections were addressed. In addition, AECB staff analyse reportable events concerning station operation to identify causes and trends.

During 1999-2000, in addition to ongoing inspections at all nuclear power stations in Canada, AECB staff developed comprehensive plans for evaluating the safety performance of all 22 licensed power reactors in Canada. AECB staff also continued its systematic review of OPG's multi-year nuclear recovery plan.

Assessment activities in 1999-2000 showed that the performance of all stations continued to be acceptably safe, although continued improvement is required in certain areas, particularly in addressing backlogs in preventative and corrective maintenance. All licensees' special safety systems met the AECB availability requirement. In addition, all licensees conducted large-scale Y2K testing on their control computers, and took part in an international exercise involving nuclear power stations and the electrical grid throughout North America. No significant problems were found during this exercise, and all licensees passed through the Y2K transition without problems related to the operation or safety of their stations.

While the overall operation of nuclear power stations in Canada was judged acceptably safe in the 1999 calendar year, licensees reported 722 unusual events, including instances of non-compliance with operating policies or procedures, AECB regulations, or licence conditions. Not all events that the AECB requires licensees to report involve failure to follow regulatory requirements. AECB reporting requirements ensure that it receives timely information that may have regulatory significance. The majority of events had only minor consequences. None had a negative impact on public safety, health or the environment. These events ranged from minor spills of radioactive heavy water to inadequate adherence to procedures. In one incident, not involving radioactive material, an operator was opening a valve on an oxygen system when it exploded. The resulting fire caused burns to the person's face, neck, forearm and hands. The licensee immediately banned operation of similar systems and informed other licensees of the incident. The licensee conducted a thorough investigation and implemented design changes before lifting the ban on system operation.

AECB staff found that the industry continued to perform well in radiation protection. During the reporting period, no worker in the Canadian nuclear power industry received a dose in excess of the regulatory limit of 50 millisieverts (mSv) per year. In fact, no one working in a nuclear power station received a dose in excess of 20 mSv per year. The average dose, defined as the collective dose divided by the number of workers exposed to radiation, varied from 1.5% to 6% of the legal limit for workers, depending on the power plant (see Table 2).

TABLE 2

Average Radiation Doses to Nuclear Power Industry Workers in 1999

	Bruce A	Bruce B	Darlington	Gentilly-2	Pickering	Point Lepreau
Average Dose Exposed Workers* (mSv)	0.56	1.93	3.35	3.48	1.59	2.48

**Note: data is for all workers receiving a non-zero radiation dose.*

Uranium Mines

As of March 31, 2000, there were 17 uranium mining facilities in Ontario, Saskatchewan and the Northwest Territories licensed by the AECB. Five operating mines are located in Saskatchewan. The remaining 12 licences are for facilities that are either shut down or in the process of being decommissioned.

At COGEMA Resources Inc.'s operation in Cluff Lake, Saskatchewan, some mining continued. The company is planning to indefinitely suspend these operations on December 31, 2000. Planning for the decommissioning of the facility is underway and the AECB determined that an environmental assessment of the project is required under the CEAA.

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In November 1999, the AECB authorized COGEMA Resources Inc. to begin milling at its McLean Lake operation in Saskatchewan, and to continue mining at the site, following an extended construction phase. An environmental assessment under the CEAA is also being carried out on a proposal to dispose of waste rock from the Cigar Lake operation at the McLean Lake facility.

At Cameco Corporation's Rabbit Lake operation, in Saskatchewan, mining of the Eagle Point underground facility stopped on March 31, 1999, and mill production was reduced to 2.7 million kilograms for the year. Cameco has proposed milling some ore from Cigar Lake at this facility. AECB staff determined that an environmental assessment is needed to determine the acceptability of milling some Cigar Lake ore at the Rabbit Lake facility. This study has been initiated and continued throughout the year.

In October 1999, the AECB approved Cameco Corporation's application to begin mining ore at the company's McArthur River Project, after completion of construction of the mining facilities.

In November 1999, the AECB approved Cameco Corporation's application to begin milling of ore that had been stockpiled at its Key Lake, Saskatchewan, operation, and to mill ore from the McArthur River Project at Key Lake, after completion of construction of ore-receiving facilities during the year.

As part of the licensing and compliance program, AECB staff carried out a total of 30 routine inspections of uranium mining facilities. The purpose of the routine inspections was to check various aspects of licensees' performance against applicable regulatory requirements. In addition, three specialist assessments were conducted. These comprised assessment of compliance with the requirements of the *Transport Packaging of Radioactive Materials Regulations* at the McLean Lake and Rabbit Lake facilities, geotechnical inspections of containment dam structures at a number of the facilities, and an in-depth evaluation of the organization and management of the McLean Lake operation. Detailed audits of the radiation protection and environmental protection programs were also carried out at the McLean Lake operation as part of the enhanced compliance evaluation program for the first year of operation.

AECB is coordinating two comprehensive studies under the CEAA. The first of these concerns the decommissioning of the Cluff Lake facility; the second, the milling of some ore from the Cigar Lake facility at the Rabbit Lake operation. These studies are continuing.

In uranium mines and mills, the AECB monitors annual exposures to radon progeny and direct exposures to radiation. In 1999, whole body doses were measured for 3,210 workers, and radon progeny exposure estimates were made for approximately 2,814 workers. No mine or mill worker exceeded the maximum permissible limits.

Uranium Processing and Fuel Fabrication

As of March 31, 2000, there were six licences issued for uranium processing and fuel fabrication operations – five for facilities in Ontario, the remaining licence for a facility in Alberta.

Cameco Corporation's refinery in Blind River, Ontario, is licensed to convert uranium ore concentrate (or "yellowcake") to uranium trioxide (UO_3). The uranium trioxide is converted at Cameco's Port Hope facility to either uranium dioxide (UO_2) powder, which is later formed into pellets to be used as fuel in CANDU reactors, or to uranium hexafluoride (UF_6) for export and subsequent production of fuel for light-water reactors. GE Canada is licensed to manufacture fuel pellets at its Toronto facility, and to assemble fuel bundles at its Peterborough manufacturing plant. Zircatec Precision Industries Limited is licensed to carry out all operations related to the manufacture of fuel pellets and fuel bundles at its Port Hope facility.

Earth Sciences Extraction Company has a facility in Calgary designed to extract uranium from impure phosphoric acid. This facility is not being operated at this time, due to market conditions, but continues to be licensed by the AECB.

As part of the licensing and compliance program, AECB staff carried out a total of 20 routine inspections at these facilities, three non-routine inspections, two audits of the health physics/ radiation protection program and aspects of the quality assurance program at Cameco's Port Hope facility and arranged for two fire protection surveys by outside consultants at Cameco's Port Hope facility and Zircatec's facility. The purpose of the routine inspections was to check various aspects of the licensees' performance against the applicable regulatory requirements. The non-routine inspections concerned the site for a new hydrogen storage/supply system at Cameco's Port Hope facility and two incidents involving release of hydrogen at GE Canada's Toronto facility, in September and December 1999. Neither of those incidents resulted in significant environmental effects. AECB staff also held meetings with licensees representatives to discuss matters concerning facilities' operations and related matters and with representatives of the Ontario Ministry of the Environment and the Low Level Radioactive Waste Management Office in Port Hope.

During the reporting period, the AECB considered applications from Cameco for the renewal of its two operating licences for the company's Blind River and Port Hope facilities, as well as from Zircatec for renewal of the operating licence for its Port Hope fuel fabrication facility. The three licences were renewed by the AECB in December 1999, each for a two-year term expiring on December 31, 2001.

In 1999, the main by-product materials from the uranium refining and conversion processes at Cameco's Blind River and Port Hope facilities in Ontario, including the inventories from past operations, were shipped to a uranium mill in New Mexico for recovery of the uranium they contained.

The AECB evaluated dose rates received by workers at uranium processing and fuel fabrication facilities. No regulatory dose limits to workers and members of the public were reached or exceeded during 1999. Of the more than 450 workers monitored for annual average whole-body dose, exposures ranged from 2.2 % to 9% of the allowable dose limit of 50 mSv. The annual maximum whole body dose received by an individual worker was 29% of the allowable dose limit.

Research Reactors

As of March 31, 2000, there were eight operating research reactors at Canadian universities – three in Ontario, two in Quebec, one each in Nova Scotia and Alberta and Saskatchewan. Six of these eight reactors are of the SLOWPOKE-2 type, designed by Atomic Energy of Canada Limited (AECL). The facility at McMaster University, Hamilton, Ontario, is a pool-type reactor and the one at École polytechnique, Montreal, Quebec, is a sub-critical assembly.

The SLOWPOKE-2 reactor at the University of Toronto was shut down in December 1998. Plans to decommission the reactor are under review by AECB staff.

Conversion of the reactor core of the McMaster reactor from high-enriched uranium to low-enriched uranium fuel is continuing and the first low-enriched uranium fuel assembly was added to the core in January 1999. The McMaster University reactor operated throughout the reporting period in a satisfactory manner.

Monitoring of the operation of research reactors showed that all were operated in an acceptable manner.

During 1999, no employees working at a research reactor received a whole-body, or single-tissue dose in excess of any of the respective quarterly or annual permissible dose rates.

Nuclear Research and Test Establishments

The AECL research facilities at Chalk River, Ontario, and Pinawa, Manitoba, are licensed by the AECB.

The Chalk River facilities include the National Research Universal (NRU) reactor and the zero-power ZED-2 reactor. The AECB is currently assessing the safety of continued NRU operations through routine compliance inspections and the review of two major projects being implemented by AECL. The NRU Upgrades Project comprises the installation of seven major safety upgrades, and the Reactor Safety Evaluation Project involves the complete revision of the NRU safety analysis report. Both projects are scheduled to be completed by late 2000. The NRU has been operated since 1957, and is expected to be shut down by the end of 2005.

In February 1999, AECL formally notified the AECB that the Whiteshell Laboratories at Pinawa, Manitoba, would be permanently shut down and decommissioned. The environmental assessment of the site, required under the CEAA, is currently under way.

At Chalk River, construction work continued on the MDS Nordion Medical Isotope Reactor Project, designed for radioisotope production. The project, consisting of two MAPLE reactors and a new radioisotope-processing facility, is being built by and will be operated by AECL, but owned by MDS Nordion. During the year, AECB staff continued a review of the applications for operating licences for the MAPLE reactors and the new processing facility. In August 1999, operating licences for the MAPLE-1 medical isotope reactor and the new processing facility were approved with terms to October 2000 (extended until April 2001, by subsequent amendments). The facilities are scheduled to be in full service by the end of 2000.

Routine compliance inspections during the reporting period indicated satisfactory operation of the Chalk River and Whiteshell nuclear research and test establishments. A total of 20 inspections were carried out at both nuclear research and test establishments.

During 1999, no employees working at a research and testing establishment received a whole-body, or single-tissue dose in excess of any of the respective quarterly or annual permissible doses rates. Sixty employees had whole-body doses greater than 10 mSv in 1999, well within the allowable limits.

Although no personal over-exposures of licensees' staff or the public resulted from the operation of any of these licensed facilities, charges under the *Atomic Energy Control Act* were laid against Atomic Energy of Canada Ltd. (AECL) as a result of an incident at AECL's Chalk River facilities on May 26, 1999. These proceedings were based on the findings of the AECB investigation into the incident. The charges relate to failure by AECL to adequately protect the health and safety of the workers involved in the incident. The AECB investigation did not reveal any detriment to the public or the environment from the incident.

Medical and Non-medical Particle Accelerators

The construction and operation of medical particle accelerators in Canada is regulated by the AECB, as these machines either use radioactive substances or generate ionizing radiation used for cancer therapy or research. The AECB continues to see an increase in the number of requests for licences for medical accelerators and radiation therapy equipment as a result of an increase in the number of cancer-treatment facilities in Canada.

For 1999-2000, there were 51 licences issued by the AECB for a total of 120 medical accelerators in use or being commissioned. Through the year, the AECB issued eight new construction approvals, seven new operating licences and three new life-cycle licences.

Non-medical particle accelerators are used in research, such as sub-atomic research and materials science, and for production of radioisotopes. There are currently 21 non-medical particle accelerators licensed in Canada. Through the year, the AECB issued one construction approval and one operating licence in addition to routine compliance activities.

Compliance activities consisted of inspections and review of annual reports. Minor discrepancies were noted and brought to the licensees' attention.

During 1999, no employees working at a medical or non-medical accelerator received a whole-body, or single-tissue dose in excess of any of the respective quarterly or annual permissible dose rates.

Prescribed Substances

During 1999-2000, there were 16 companies holding 21 prescribed substance licences for uranium, thorium or heavy water. The type of licensed activities included possession and storage, analysis, research, experimental detection of solar neutrinos, and multiple commercial uses such as aircraft counterweights, radiation shielding, calibration devices, thoria-dispersed nickel powder and analytical standards.

The prescribed substance licences are being incorporated into regular radioisotope licences. As of March 31, 2000, three prescribed substance licences were integrated in consolidated or laboratory studies radioisotope licences.

Radioisotopes

As of March 31, 2000, there were 3,651 radioisotope licences in effect. Radioisotopes are widely used in research, in medicine for diagnostic and therapeutic purposes, and in many industrial tasks including quality control and process control. Radioisotopes are also used in certain other devices, such as smoke detectors and tritium exit signs. Because the quantity of radioactive material in these devices is small and the device meets internationally-accepted safety standards, the end-user is exempt from licensing. However, the manufacturer, distributor and importer of these devices must be licensed by the AECB.

AECB inspectors routinely verify compliance of radioisotope licensees, and carried out 2,433 inspections of radioisotope licensees in 1999-2000. These inspections identified 3,685 violations of AECB regulations or licence conditions. Of these violations, 1,727 were minor, 1,697 were moderate and 261 were major items of non-compliance. A total of 27 Stop Work Directives were issued against licensees during the same time period. In all cases of non-compliance, satisfactory corrective actions were undertaken by the licensee, either immediately or within the time period specified by the inspector. The Stop Work Directives were suspended following verification that all health and safety issues were resolved.

AECB inspectors also respond to unusual occurrences and, in 1999-2000, 104 incidents were reported to the AECB, compared with 142 the previous year. Incidents investigated occurred in several sectors, including oil and gas, medical, those using specialized gauges, scrap metal and other industries. Among these incidents were six major spills, which occurred in controlled areas of medical and production facilities. AECB staff verified the cleanup and corrective action in each incident. In addition, charges were laid

Incidents Involving Radioisotopes

Oil and Gas
- 4 sources stuck in wells, later recovered
- 3 sources abandoned (cemented in place) in boreholes

Portable Gauges
- 1 overpack stolen
- 9 crushed gauges
- 1 gauge lost (courier), later recovered
- 5 gauges stolen; 1 recovered

Fixed Gauges
- 2 gauges improperly used;
- 1 overexposure;
- 1 unauthorized vessel entry;
- 3 equipment failures

Industry
- 2 over-exposures

Medical/Academic
- 1 over-exposure
- 5 small lost sources
- 6 major spills

Scrap Metal
- 47 shipments rejected, returned to point of origin;
- 12 shipments returned to the U.S.A.; all with naturally-occuring radioactive material (NORM)

Other
- 1 possible radioactive material in public domain ("false alarm" material confirmed non-radioactive)

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against the Cape Breton Development Corporation (DEVCO) as a result of an inspection and follow-up investigation conducted at the Phalen mine site in Nova Scotia. The incident involved the malfunction of a fixed gauge containing the isotope Cs-137. In March 2000, DEVCO pleaded guilty to seven offences.

In December 1999, the AECB ordered the University Health Network in Toronto to cease the use of radioactive materials in about 100 laboratories, after graduated enforcement actions. The licensee has responded with significant addition of qualified manpower and a new documented radiation protection program is being implemented. As of March 31, 2000, several of the licence restrictions had been removed and about half of the closed laboratories had resumed operation.

Packaging and Transportation

The packaging of radioactive materials transported in Canada must conform with a number of the AECB's regulatory requirements. The AECB also cooperates with Transport Canada in regulating the carriage of radioactive materials under the *Transportation of Dangerous Goods Act*. Safety standards are based, in large part, on requirements of the International Atomic Energy Agency (IAEA), the International Maritime Organization (IMO) and the International Civil Aviation Organization (ICAO). The AECB contributes to the IAEA, IMO and ICAO in the development of transport regulations through technical meetings and research programs, and assists in the development of IAEA databases for accidents and for approved package designs for use internationally.

During 1999-2000, the AECB applied safety standards to the design of packages used to transport radioactive materials and to shipment approvals. The AECB issued 45 certificates that included four special arrangement certificates, 20 endorsements of foreign certificates and 21 Canadian-origin package certificates, which included three special-form certificates. As of March 31, 2000, there were 103 valid certificates, of which 58 were for Canadian packages and 45 were for endorsements of foreign-origin packages. These certificates were employed by more than 285 registered users.

In Canada, some one million packages of radioactive material are transported annually by road, rail, sea and air. During 1999-2000, there were 23 incidents reported involving the transport of radioactive material. None of these incidents resulted in the exposure of workers or the public to radiation, nor was there any significant environmental degradation. The most common incidents involved the incorrect labelling, documentation, marking or preparation of packages. Others occurred when packages were misplaced or damaged. The AECB's transportation staff and regional inspectors also conducted more than 1,450 transport compliance actions. Compliance actions included inspections, routine and special investigations, review and response to emergencies.

Waste Management Facilities

As of March 31, 2000, there were 19 radioactive waste management facilities licensed for operation. These facilities are located across the country – 12 in Ontario, two in Quebec, two in Alberta, one each in Saskatchewan and New Brunswick. A licence is also held by the Low-Level Radioactive Waste Management Office, established by the federal government to manage low-level historic wastes at a number of sites across Canada. In addition, there were waste management activities associated with other AECB licences, namely Atomic Energy of Canada Limited's (AECL) laboratories in Ontario and Manitoba, and active and decommissioned uranium mining/milling operations in the Northwest Territories, Saskatchewan and Ontario.

Spent fuel from a power reactor is highly radioactive and remains so for a long time. It is stored initially underwater in large pools at the reactor site. After a minimum number of years in pools, some of the spent fuel is stored in dry concrete containers until a permanent disposal facility becomes available.

Hydro-Québec is licensed to store irradiated fuel at its Gentilly-2 nuclear generating station in an on-site modular-type (CANSTOR) concrete container facility. New Brunswick Power also stores irradiated fuel from the Point Lepreau nuclear generating station in an on-site dry concrete container facility.

Ontario Power Generation Inc. (OPG) is licensed to store irradiated fuel from the Pickering nuclear generating station in concrete containers at a dry storage facility at the site. In August 1998, OPG applied for AECB authorization to expand this dry storage facility. The AECB determined that this project required an environmental assessment under the CEAA, which was completed in May 1999. AECB authorization to construct the expansion was issued the same month. Approval by the AECB will be required before the expanded dry storage facility can operate.

In July 1996, OPG (then Ontario Hydro) applied for approval to construct a dry storage facility for irradiated fuel produced at the Bruce A and B nuclear generating stations. Following the required environmental assessment under the CEAA, in April 1999, the Minister of the Environment concluded that the proposed project is not likely to cause significant adverse environmental effects and referred the project back to the AECB for continuation of its licensing process. On January 20, 2000, the AECB issued a construction approval to OPG. An operating licence from the AECB will be required before the facility can be used. An application for Judicial Review in relation to the environmental assessment for this project, was still before the Federal Court at the end of the period covered by this report.

Other radioactive wastes resulting from reactor operations are stored in a variety of engineered structures in licensed waste-management facilities located at reactor sites. The structures consist of in-ground concrete trenches, concrete tile-holes, above-ground concrete structures and warehouse-type buildings, which are suitable for this type of waste since it is much less radioactive than spent fuel. Prior to storage, the volume of the wastes may be reduced by incineration, compaction or baling. As well, there are facilities for the decontamination of parts and tools, laundering of protective clothing and the refurbishment and rehabilitation of equipment.

In October 1996, AECL submitted a revised application for construction of the Intrusion Resistant Underground Structure (IRUS) disposal facility at its Chalk River Laboratories. The IRUS facility would be used for the disposal of low-level solid radioactive waste now held in storage at the Chalk River site. In April 1997, AECB staff provided preliminary comments to AECL on the revised application, and AECL performed additional analyses and submitted additional documentation in 1998. AECB staff completed the review of this documentation in 1999 and AECL is currently reviewing outstanding issues.

A number of waste-management facilities are licensed to process and manage the wastes that result from the use of radioisotopes in research and medicine. In general, these facilities collect and package waste for shipment to approved storage sites. In some cases, waste is incinerated or allowed to decay to insignificant levels of radioactivity.

Activities with respect to the consolidation and eventual disposal of historic wastes (low-level radioactive waste for which the original producer cannot be held responsible) are also monitored by the AECB. The federal government is responsible for these historic wastes through the Low-Level Radioactive Waste Management Office (LLRWMO), operated by AECL under agreement with Natural Resources Canada.

The LLRWMO undertakes certain initiatives with respect to accumulations of historic waste at various locations, including the towns of Port Hope, Ontario, and Fort McMurray, Alberta, in anticipation of its ultimate transfer to an appropriate disposal facility. The Office has, in most instances, consolidated waste accumulations and established temporary holding facilities for wastes uncovered during routine excavation within the two towns. Where appropriate, the AECB has issued licences for particular waste accumulations.

To verify compliance, AECB staff conducted 40 compliance visits at radioactive waste facilities and sites, including radiation measurements, contamination measurements and sampling, as well as reviews of licensee documentation and reports.

Members of the public do not receive any significant dose of radiation from radioactive waste contained in licensed facilities. Only in a few facilities is it possible for workers to be exposed while handling the waste. During the reporting period, no workers received doses in excess of regulatory limits.

Decommissioning

The shutdown and decommissioning of facilities licensed by the AECB must be accomplished safely, according to plans approved by the Board.

AECB staff continued to monitor and review major decommissioning projects at AECL's Whiteshell and Chalk River laboratories. In 1999, AECL submitted documents in preparation for decommissioning of the Whiteshell Laboratories. Review of this documentation determined that an environmental assessment would be required under the provisions of the CEAA. The scope of the environmental assessment was posted on the AECB's Web site in December 1999. The AECB is the lead regulatory agency on this project and is coordinating the environmental review with other federal and provincial agencies.

AECB staff continued to monitor AECL's partially decommissioned Douglas Point, NPD and Gentilly-1 demonstration power reactors, as well as the WR-1 reactor at AECL's Whiteshell Laboratories and the NRX reactor at Chalk River Laboratories. These reactors now are in a state of "storage-with-surveillance", to permit the decay of radioactivity in the reactor, thus reducing radiation dose to workers involved in the final dismantling.

AECB staff is currently reviewing the final version of the environmental assessment for the decommissioning of OPG's Bruce Heavy Water Plant, submitted by OPG in late 1999. The report will also be reviewed by other federal agencies prior to it being submitted to the Canadian Environmental Assessment Agency for public consultation.

In 1999, the AECB initiated its review of the detailed decommissioning plan submitted by the University of Toronto with respect to its SLOWPOKE research reactor. The review is continuing.

AECB staff continued to receive decommissioning plans for the above-noted facilities and others across Canada and to assess their content against applicable criteria and standards. In addition, AECB staff conducted periodic compliance inspections at nuclear facilities that have been shut down or are undergoing active decommissioning.

On April 29, 1999, the AECB amended the decommissioning licences for Denison Mines Ltd.'s Stanrock and Denison mine sites, to reflect the successful completion of all major site decommissioning actions. AECB staff conducted spring and fall inspections of both facilities with members of the Joint Review Group from the Province of Ontario and other federal departments. Site environmental audit sampling conducted during the year verified that the treatment plants met AECB licence discharge limits. In addition, geotechnical inspections were performed on the structures containing the tailings.

Permanent emergency spillways were constructed at both the Quirke and Panel waste-management areas (Rio Algom Mines Ltd.). At Rio's Stanleigh facility, all site remediation at the former mine/processing site has been completed, including the capping of all underground openings. Rio Algom has implemented a program to enhance the stability of all tailings containment structures at its other closed mine sites in the Elliott Lake region, and documentation was submitted to the AECB in support of licensing these sites.

In September 1999, the Serpent River Watershed and In-Basin Region monitoring program was initiated jointly by Rio Algom and Denison. This program will assess the impact of the recently-completed mine decommissioning on the downstream environment. Staff from the AECB and relevant provincial and federal agencies will review the results of the program to verify the predictions made in the Environmental Impact Statements associated with the decommissioned mining facilities.

Members of the public do not receive any significant dose of radiation resulting from decommissioning activities. Only in a few facilities undergoing decommissioning is it possible for workers to be exposed while handling contaminated material or waste. During the reporting period, no workers received doses in excess of regulatory limits.

FULFILLING CANADA'S NON-PROLIFERATION AND SAFEGUARDS OBLIGATIONS

Nuclear Non-proliferation

In support of Canada's nuclear non-proliferation policy, the AECB continued its activities to assure that Canada's nuclear exports are used only for peaceful purposes, and to contribute to the emergence of a more effective and comprehensive international nuclear non-proliferation regime.

The AECB, as implementing agency for Canada's non-proliferation commitments, participates with the Department of Foreign Affairs and International Trade (DFAIT) in the negotiation of bilateral Nuclear Cooperation Agreements between Canada and its nuclear partners. Currently there are 23 agreements in force covering 37 countries.

The AECB also negotiates and implements, with its counterparts in other countries, administrative arrangements aimed at ensuring that nuclear cooperation is conducted within the terms of Canada's nuclear cooperation agreements. During the reporting period, AECB staff participated in bilateral nuclear policy and/or technical consultations with a number of Canada's nuclear partners, including Australia, China, the Republic of Korea, the United States and the European Atomic Energy Community.

AECB staff participated in multilateral nuclear non-proliferation meetings on nuclear export controls and nuclear transfers for peaceful purposes, including the meetings of the Zangger Committee and the Nuclear Suppliers Group and the preparatory meetings for the 2000 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons. The AECB provides advice to DFAIT on the development and application of Canada's nuclear non-proliferation policy.

The AECB also participated in the activities of the Uranium Exports Review Panel to assure consistency of uranium sales agreements with uranium export policy.

Import and Export Control

In 1999-2000, the AECB continued to license the import and export of nuclear materials. Items intended for import and export are evaluated by AECB staff to ensure compliance with international agreements related to safeguards, health, safety and security. Shipments of uranium, deuterium, equipment and technology are evaluated to ensure compliance with Canada's nuclear non-proliferation and export policies.

During the reporting period, the AECB issued or amended 564 nuclear export licences with a value of $2.2 billion (for exports of nuclear material, heavy water, tritium, nuclear equipment, nuclear technology and dual-use exports) and 247 nuclear import licences, including transshipments, with a value of $1.1 billion (for imports of nuclear material, heavy water, tritium). A total of 7,146 tonnes of Canadian natural uranium subject to licences issued by the AECB were exported during the 1999 calendar year.

Safeguards
The AECB administers the agreement between Canada and the International Atomic Energy Agency (IAEA) for the application of safeguards to nuclear activities in Canada. The exclusive purpose of this safeguards agreement is to verify that Canada's obligations under the non-proliferation treaty are being met. AECB staff coordinate the access and activities of IAEA inspectors who are authorized to carry out safeguards inspections and activities at nuclear facilities in Canada.

As part of its obligations for 1999, the AECB submitted to the IAEA 446 reports detailing 15,061 transactions involving nuclear material. At the end of 1999, Canada had 35,191 tonnes of nuclear material under safeguards and subject to IAEA inspection.

In 1999-2000, the AECB amended 57 licences, clarifying safeguards licence conditions. AECB staff also monitored licensees to verify compliance with these new licence conditions.

In 1998, Canada signed the *Additional Protocol* to its Safeguards Agreement with the IAEA, thereby giving the IAEA a basis to implement strengthened safeguards measures. The *Additional Protocol* provides the IAEA with increased access to information and locations associated with a state's nuclear fuel cycle so that the IAEA will be better positioned to determine the completeness of a state's declaration of its nuclear material and activities. That is, the IAEA will have improved capability to provide assurances that clandestine nuclear activities are not occurring in a country. In 1999-2000, the AECB continued to inform stakeholders of the requirements for Protocol implementation, and worked closely with licensees and industry to assemble information for the initial declaration requirements. The *Additional Protocol* is expected to come into force in 2000.

Canada is represented by an AECB staff member on the IAEA's Standing Advisory Group on Safeguards Implementation. The AECB also provided expertise to the Canadian delegation to assist efforts to implement the Comprehensive Test Ban Treaty.

Canadian Safeguards Support Program (CSSP)
Since 1976, Canada has undertaken a safeguards research and development program to supplement the resources of the IAEA and the operational efforts of the AECB in resolving specific safeguards concerns. The program undertakes safeguards studies, development of equipment, techniques and procedures, and training, and provides cost-free experts to the IAEA. This program is delivered by the AECB.

During the reporting period, the CSSP undertook 27 projects ranging from development of radiation monitoring equipment for safeguards purposes, training on CSSP-developed equipment, application of satellite imaging for safeguards, and assistance to the IAEA evolution of its safeguards system with the introduction of the *Additional Protocol*. In addition, the CSSP provided cost-free experts to the IAEA including an expert provided to serve with the IAEA Action Team set up under the UN Security Council to eliminate Iraq's weapons of mass destruction and the means to produce them.

Security
In addition to regulating domestic security requirements, the AECB, in conjunction with DFAIT, scrutinized approximately 400 applications for the export or import of nuclear materials for security implications. The AECB also provides expertise to the IAEA in response to growing international concerns with the regulatory framework supporting the physical security of nuclear facilities and the problem of illicit trafficking involving nuclear materials and radioactive substances.

MANAGING AND ADMINISTERING THE ORGANIZATION

Audit and Evaluation
The AECB corporate audit and evaluation group reports directly to the President. During the reporting period, the group continued work in support of its mandate to review program performance and management effectiveness. Management acted on the key findings of a review of the way in which AECB staff availed themselves of services provided by the Legal Services Unit. An audit of internal Y2K preparedness was completed. A review on regulatory assessment of authorized power plant staff was reported in the period and commitments were made to introduce corrective measures related to the report's findings. A strategic review of internal information technology systems under development now is at the reporting phase.

As part of its on-going responsibilities, the Office of the Auditor General performed an annual audit of the AECB financial statement and value-for-money audit work including limited work on AECB's regulatory role relating to selected licensees' Y2K preparedness.

Communications
Communications Division's objective is to build awareness and understanding of the AECB, and raise public confidence in the AECB as an independent, competent and effective regulator.

During the reporting period, foundations were laid for enhanced communication responsibilities under the *Nuclear Safety and Control Act.* In the 1999-2000 fiscal year, the AECB launched a new Web site that will allow it to reach target audiences in a more effective manner. In the future, the Internet will be used more, as a key communications tool. Other work, related to the transition to the Canadian Nuclear Safety Commission, involved the development of a corporate identity program for the new organization. A number of studies were also undertaken to better understand the information needs of the AECB/CNSC's target audiences.

Corporate Planning
In 1999-2000, Executive Committee approved an integrated approach to corporate planning. This approach includes the implementation of a formal planning cycle with strategic planning sessions of senior management, the formation of the Corporate Reports Committee to coordinate the preparation of corporate planning documents, and the submission of a Business Plan to Treasury Board.

Cost Recovery

The AECB's *Cost Recovery Fees Regulations* were first introduced in 1990 in accordance with Government of Canada policy on user charges. The Government's policy was replaced in 1997 by the Cost Recovery and Charging Policy.

In 1999-2000, the AECB recovered 77.5% percent of its $48.6 million recoverable licensing costs through fees charged for licences and permits. All funds recovered were deposited in the Consolidated Revenue Fund. In addition, costs of $5.5 million were incurred to license publicly-funded health care institutions, educational institutions and federal departments. These organizations are exempt from fees.

During the reporting period, the AECB began a review of its cost recovery program. One of the key elements of this review is a comprehensive and transparent consultation process with licensees providing them with an opportunity to comment on the new cost recovery structure.

Human Resources

The AECB continued to reform and modernize its human resources practices during 1999-2000. The foundation for the AECB's long-term human resources plan was strengthened this year with the introduction of policies to enhance staff mobility, improve recruitment and retention, and clarify roles in the delivery of human resource services. The President also launched the first phase of a comprehensive succession management program aimed at identifying and preparing the organization's future leaders. Building on the previous year's development program for its executives, the AECB focused its 1999-2000 leadership training effort on first-line managers. Both the succession management program and the leadership training effort were based on the competency profiles developed in 1998-1999.

Work on revamping the occupational group and salary band structure was completed with the conversion of executive personnel to the new structure coming into effect on June 1, 1999. The AECB also initiated a complete review of its employment systems to identify any obstacles that may hinder its efforts to be an employer which fully respects, promotes, and capitalizes on diversity within its workforce.

Regulatory Research and Support

The AECB funds a mission-oriented research and support program to augment in-house effort on regulatory activities. This work is contracted out to the private sector and to other agencies and organizations. The objective of the program is to produce pertinent and independent information that will assist the AECB in making sound, timely and credible decisions. Where appropriate, joint programs are undertaken with other organizations (such as other government departments or agencies) to maximize the value obtained.

Distribution of Funding for 1999-2000

Nuclear Reactors	43%
Health Physics	20%
Non-Fuel Cycle Applications	11%
Waste Management	9%
Uranium Mines and Mills	4%
Other Fuel Cycle Facilities, General	4%
Special Services	4%
Regulations & Regulatory Process Development	3%
Transportation	2%

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Transportation	2%

During the reporting period, the total expenditure on mission-oriented regulatory research and support contracts was approximately $2.3 million. Projects in the program were organized and managed in nine sub-program groups that reflect discipline-related themes, to provide a rational means of budget allocation and to make the program more visible and transparent. Table 4 gives a breakdown of expenditure by sub-program group.

Reports issued by contractors on the work done in the research and support program are made available as public information.

Technical Training

The Technical Training Group designs, develops, delivers, evaluates and manages training programs to meet the technical and regulatory competency needs of AECB staff, and of several foreign regulatory agencies.

Training on the new Act and on its regulations continued to be the highest priority for 1999-2000. Eighteen training sessions, totalling 62 days, were offered to 418 staff members. Since July 1999, increasing effort was placed on the design and development of the training program on the regulations under the new Act.

In support of the Canadian Nuclear Safety Initiative, which has the objective of enhancing the safety of Soviet-designed nuclear power stations, the AECB continued its agreement with the Canadian International Development Agency to provide training to staff of nuclear regulatory agencies in Russia and Ukraine. Two training programs were offered to 12 Ukrainian inspectors on decommissioning and radiation protection. Two separate scientific visits were arranged for senior regulators from Russia and Ukraine on the Canadian approach to regulation and the integrated licensing process currently used by the AECB.

Under an agreement with Atomic Energy of Canada Limited, the AECB continued to provide training on Canadian regulatory practices and standards as applied to CANDU nuclear power plants for regulatory staff from China and Korea. Cooperation between the AECB and its Korean counterpart also resulted in the sending of four AECB inspectors to observe, alongside their Korean colleagues, the commissioning of a CANDU unit in Korea.

Section III
The Challenges Ahead

On May 31, 2000, the AECB became the Canadian Nuclear Safety Commission (CNSC), with a clearer and stronger mandate to establish and enforce health, safety, security and environmental standards. The international as well as Canadian nuclear scene is changing rapidly, and the CNSC must continue to play a strong role in fulfilling Canada's international obligations related to the peaceful use of nuclear energy.

The most urgent challenge facing Canada's nuclear regulator in the coming year – and its top priority – is to ensure the effective implementation of the new Act and regulations. The new regulatory regime and related processes must be fully documented, understood and applied.

All operational program plans, budgets and activities must be aligned with the new Act. Appropriate, visible and effective processes must be developed to support new authorities and responsibilities. These changes are already being implemented and communicated to staff, licensees, the public and other stakeholders to ensure they are fully aware of regulatory requirements and expectations.

Over the coming year, all transition plans related to the new regulatory regime must be finalized and put into effect. All priority regulatory documents must be issued, either in final form or for consultation. Initial training related to the new regulations must be completed, and all staff members must be competent to operate under the new regime.

Within the organization, succession planning will continue to be addressed, and capabilities improved for recruiting and retaining the staff needed for efficient and effective fulfilment of the organization's responsibilities.

Other challenges include deregulation of the electrical power production industry, radioactive waste management and ongoing public concern over nuclear safety. The deregulation of electricity markets has led to privatization initiatives regarding OPG's nuclear power plants. But increased competition created by commercial deregulation must not lead to decreased attention to safety. Similarly, deregulation and privatization initiatives must not slow progress in ensuring that appropriate waste-management strategies and decommissioning plans are in place and being implemented.

Public and media interest in nuclear issues continues, with particular scrutiny of domestic nuclear power reactor operations, and issues related to the environment, health and the transportation of nuclear substances. The actions of domestic and international regulatory bodies will continue to be questioned. The challenge for the CNSC is to continue to strengthen the regulatory regime in an ever-changing context and to reassure Canadians that their interests are being protected. Canada's nuclear regulator must continue to involve the public in the regulatory process in meaningful ways, and must continue to communicate information about the decisions it makes.

ANNEX I
ADVISORY COMMITTEE ON RADIOLOGICAL PROTECTION
AS OF MARCH 31, 2000

Dr. J.B. Sutherland (Chair)	Professor, Department of Radiology (retired) University of Manitoba Winnipeg, Manitoba
Dr. Douglas B. Chambers (Vice-Chair)	SENES Consultants Ltd. Richmond Hill, Ontario
Dr. Albert A. Driedger	London Health Sciences Centre London, Ontario
Dr. Jocelyn Hébert	Consultant, Centrale nucléaire de Gentilly-2 Gentilly, Quebec
Dr. Harry M. Johnson	Manitoba Cancer Treatment and Research Foundation Winnipeg, Manitoba
Dr. Jean-François Lafortune	International Safety Research Ottawa, Ontario
Dr. Jan T.W. Lim	Vancouver Island Cancer Centre Victoria, British Columbia
Mrs. Lysanne Normandeau	Centre hospitalier de l'Université de Montréal Montreal, Quebec
Mr. Peter F. O'Brien	Toronto-Sunnybrook Regional Cancer Centre Toronto, Ontario

ANNEX I (CONTINUED)
ADVISORY COMMITTEE ON RADIOLOGICAL PROTECTION
AS OF MARCH 31, 2000

Dr. Richard V. Osborne	Consultant Deep River, Ontario
Dr. Michel Plante	Consultant, Hydro-Québec Montreal, Quebec
Dr. Slavica Vlahovich (AECB Medical Liaison Officer)	Radiation Protection Bureau, Health Canada Ottawa, Ontario
Mr. Michael White	Safety Management Services Inc. Pickering, Ontario
Dr. Kam Y. Wong	Consultant Etobicoke, Ontario
Dr. Robert J. Woods	Professor Emeritus, Department of chemistry (retired) University of Saskatchewan Saskatoon, Saskatchewan
Dr. André Biron (*ex officio*)	Chair Advisory Committee on Nuclear Safety
Mr. Marc Lupien (Scientific Advisor)	Atomic Energy Control Board Ottawa, Ontario

ANNEX II
ADVISORY COMMITTEE ON NUCLEAR SAFETY
AS OF MARCH 31, 2000

Dr. André Biron (Chair)	Centre de recherche en calcul appliqué (retired) Montreal, Quebec
Mr. P. Gordon Mallory (Vice-Chair)	Consultant Peterborough, Ontario
Dr. A. Pearson (Past-Chair)	Consultant Deep River, Ontario
Dr. Annick H. Boisset	Consultant Montreal, Quebec
Mr. S.E. Frost	Cameco Corporation (retired) Saskatoon, Saskatchewan
Dr. J. Roger Humphries	Consultant Nepean, Ontario
Mr. J.J. Lipsett	Atomic Energy of Canada Limited (retired) Chalk River, Ontario
Mr. John G. McManus	Consultant Almonte, Ontario
Dr. Eva L.J. Rosinger	Consultant Canmore, Alberta
Dr. J.B. Sutherland (*ex officio*)	Chair Advisory Committee on Radiological Protection
Mr. Marc Lupien (Scientific Advisor)	Atomic Energy Control Board Ottawa, Ontario

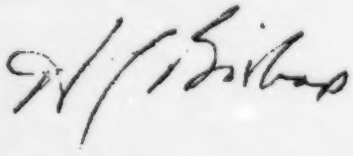
Financial Statement

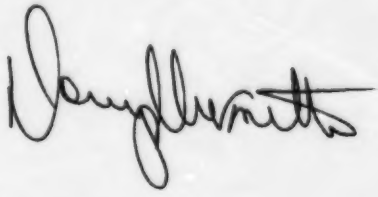
MANAGEMENT REPORT

The management of the Atomic Energy Control Board is responsible for the preparation of all information included in its annual report. The financial statement has been prepared in accordance with the reporting requirements and standards established by the Receiver General for Canada for departmental corporations. The financial statement includes estimates that reflect management's best judgements. Financial information included elsewhere in the annual report is consistent with the financial statement.

Management is also responsible for developing and maintaining a system of internal control designed to provide reasonable assurance that all transactions are accurately recorded and that they comply with the relevant authorities, that the financial statement reports the Atomic Energy Control Board's results of operations and that the assets are safeguarded.

The Auditor General of Canada conducts an independent audit and expresses an opinion on the financial statement.





A.J. Bishop, M.D.
President

Denys Vermette
Director General of Corporate Services

Ottawa, Canada
June 2, 2000

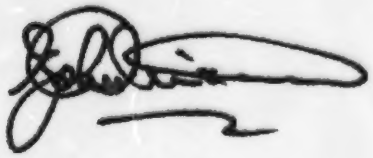
AUDITOR'S REPORT

To the Atomic Energy Control Board
and the
Minister of Natural Resources Canada

I have audited the statement of operations of the Atomic Energy Control Board for the year ended March 31, 2000. This financial statement is the responsibility of the Board's management. My responsibility is to express an opinion on this financial statement based on my audit.

I conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statement is free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In my opinion, this financial statement presents fairly, in all material respects, the results of operations of the Board for the year ended March 31, 2000 in accordance with the accounting policies set out in Note 2 to the financial statement.



John Wiersema, CA
Assistant Auditor General
for the Auditor General of Canada

Ottawa, Canada
June 2, 2000

STATEMENT OF OPERATIONS *(FOR THE YEAR ENDED MARCH 31, 2000)*

Expenditures	**2000**	**1999**
Operations		
Salaries and employee benefits	$35,557,875	$34,338,373
Professional and special services	9,907,932	7,576,176
Accommodation	4,153,444	4,380,196
Travel and relocation	3,129,619	2,508,376
Furniture and equipment	2,703,446	1,683,382
Communication	670,741	669,088
Utilities, materials and supplies	586,619	972,054
Information	583,053	500,001
Repairs	398,592	231,455
Board Members' expenses	391,658	381,064
Equipment rentals	110,257	99,018
Miscellaneous	7,680	17,747
	58,200,916	53,356,930
Grants and contributions		
Safeguards Support Program	598,307	589,138
Other	69,960	45,000
	668,267	634,138
Total expenditures	58,869,183	53,991,068
Non-tax revenue		
Licence fees	37,642,199	36,486,929
Foreign training (Note 9)	1,985,028	712,506
Capital assets disposal	50,529	6,845
Miscellaneous	38,170	2,377
Refunds of previous years' expenditure	28,243	72,644
Total non-tax revenue	39,744,169	37,281,301
Net cost of operations (Note 3)	$19,125,014	$16,709,767

The accompanying notes are
an integral part of this statement.

Approved by:

A.J. Bishop, M.D.
President

Denys Vermette
Director General of Corporate Services

NOTES TO THE STATEMENT OF OPERATIONS

1. Authority, Objective and Operations

The Atomic Energy Control Board (AECB) was established in 1946, by the *Atomic Energy Control Act*. It is a departmental corporation named in Schedule II to the *Financial Administration Act* and currently reports to Parliament through the Minister of Natural Resources Canada.

The objective of the AECB is to regulate in such a manner that nuclear energy in Canada is only used with due regard to health, safety, security and the environment, and to support Canada's participation in international measures to prevent the proliferation of nuclear weapons. The AECB achieves this objective by controlling the development, application and use of nuclear energy in Canada, and by participating on behalf of Canada in international measures of control.

The AECB administers the *Nuclear Liability Act*, including designating nuclear installations and prescribing basic insurance to be carried by the operators of such nuclear installations, and the administration of supplementary insurance coverage premiums for these installations. The sum of the basic insurance and supplementary insurance totals $75 million for each designated installation (Note 10). The number of installations requiring insurance coverage is 14.

The AECB's expenditure is funded by a budgetary lapsing authority. Revenue, including licence fees, is deposited to the Consolidated Revenue Fund and is not available for use by the AECB. Employee benefits are authorized by a statutory authority.

On April 1, 1990, the AECB *Cost Recovery Fees Regulations* came into effect. The general intent of these regulations is the recovery of all operating and administration expenditures of the AECB's regulatory activities relating to the commercial use of nuclear energy from the users of such nuclear energy. Educational institutions, publicly funded non-profit health care institutions and federal government departments are exempt from these regulations. The AECB expenditures associated with exempt organizations and expenditures related to its international safeguards and import/export activities are to remain as a cost to the Government.

Fees for each licence type have been established based on the AECB's expenditures for carrying out its regulatory activities. These include the technical assessment of licence applications, compliance inspections to ensure that licensees are operating in accordance with the conditions of their licence, and the development of licence standards. Revised fees based on expenditures for 1992/93 regulatory activities were implemented on August 21, 1996.

On March 20, 1997, the federal *Nuclear Safety and Control Act* received Royal Assent. It was proclaimed by order of the Governor in Council and came into force on May 31, 2000, at which time the AECB became known as the Canadian Nuclear Safety Commission (CNSC).

The *Nuclear Safety and Control Act* mandates the CNSC to establish and enforce national standards in the areas of health, safety and environment. It establishes a basis for implementing Canadian policy and fulfilling Canada's obligations with respect to the non-proliferation of nuclear weapons. Enactment also provides CNSC compliance inspectors with clearer, fuller powers and brings penalties for infractions in line with current legislative practices. The CNSC is empowered to require financial guarantees, and order remedial action in hazardous situations. Responsible parties are required to bear the costs of decontamination and other remedial measures. As well, the *Nuclear Safety and Control Act* provides for the recovery of costs of regulation from persons licensed under the Act.

NOTES TO THE STATEMENT OF OPERATIONS

2. Significant Accounting Policies

The Receiver General for Canada specifies the reporting requirements and standards for departmental corporations. The AECB's most significant accounting policies are as follows:

a) Expenditure recognition

i) Expenditures are recorded on an accrual basis with the exception of employee termination benefits and vacation pay which are recorded on a cash basis.

ii) Estimates of amounts for services provided without charge by government departments are included in expenditures.

b) Revenue recognition

i) Licence fees are recorded as revenue on a straight-line basis over the life of the licence (normally one or two years), except for licence fees regarding an application for a construction approval of a nuclear reactor in which case they are recognized over the period of the work performed by the AECB.

ii) Revenue for foreign training is recognized over the period of the work performed by the AECB.

iii) Refunds of previous years' expenditure are recorded as revenue when received and are not deducted from expenditures.

c) Capital purchases

Acquisitions of capital assets are charged to operating expenditures in the year of purchase.

d) Contributions to superannuation plan

AECB employees participate in the superannuation plan administered by the Government of Canada and contribute equally with the AECB to the cost of the plan. Contributions by the AECB are charged to expenditure when disbursed.

NOTES TO THE STATEMENT OF OPERATIONS

3. Use of Parliamentary Appropriations

		2000	1999
Vote 20 — Atomic Energy Control Board		$48,277,133	$46,163,233
Less:	Frozen allotment*	(141,986)	(1,463,267)
	Lapsed	(736,394)	(1,321,987)
		47,398,753	43,377,979
Add:	Statutory contributions to employee benefit plans	6,347,000	5,386,000
Total appropriations used		53,745,753	48,763,979
Add:	Services provided without charge by other government departments:		
	Accommodation	3,420,651	3,393,974
	Employee benefits	1,537,414	1,752,790
	Other	165,364	80,325
		5,123,430	5,227,089
Total expenditures		58,869,183	53,991,068
Less:	Non-tax revenue	(39,744,169)	(37,281,301)
Net cost of operations		$19,125,014	$16,709,767

* Funds not available for use in the year.

4. Accounts Receivable

	2000	1999
As of March 31, the amounts for accounts receivable are as follows:		
Licence fees	$1,008,283	$1,454,730
Foreign training	720	—
Total accounts receivable	$1,009,003	$1,454,730

5. Deferred Revenue

As of March 31, 2000, there are unearned licence fees received in the amount of $15,251,462 (1999 — $22,402,729). As at March 31, 2000 there are unearned foreign training fees received in the amount of $nil (1999 — $484,661).

NOTES TO THE STATEMENT OF OPERATIONS

6. Liabilities

	2000	1999
As of March 31, the amounts of the following liabilities are:		
Accounts payable and accrued liabilities	$5,171,194	$4,888,874
Salaries payable	1,712,170	543,053
Contractors' holdbacks	77,805	48,138
	6,961,169	5,480,065
Vacation pay	2,444,815	2,243,165
Employee termination benefits	2,691,129	2,455,473
	5,135,944	4,698,638
Total	$12,097,113	$10,178,703

7. Licences Provided Free of Charge

The value of licences provided free of charge to educational institutions, publicly funded non-profit health care institutions and federal government departments for the year ended March 31, 2000 amounted to $2,568,156 (1999 — $2,423,663).

8. Contingent Liabilities

The AECB is involved in a number of judicial actions that have arisen in the normal course of operations. One of these claims is for $55,000,000. However, the final outcome with respect to claims and legal proceedings pending at March 31, 2000 is not determinable and no estimate of the amount can be made. Accordingly, no provision has been made in the accounts for these contingent liabilities. Payment of any settlement or judgement resulting from the resolution of any of these cases is governed by government policy. Payment would be from funds appropriated to the AECB and charged to expenditures when payable.

9. Related Party Transactions

The AECB enters into transactions with other government departments, agencies and Crown corporations, including Atomic Energy of Canada limited (AECL), in the normal course of business.

On behalf of AECL, the AECB continues to develop, deliver and administer regulatory services for Chinese and Korean regulatory staff over a period of five years ending March 31, 2001. In accordance with the terms of the contract, the cost of the service is recovered from AECL. For 2000, the AECB recognized revenue of $1,466,922 from this project (1999 — $580,705).

NOTES TO THE STATEMENT OF OPERATIONS

10. Nuclear Liability Reinsurance Account

Under the *Nuclear Liability Act*, all premiums paid by the operators of nuclear installations for supplementary insurance coverage are credited to a Nuclear Liability Reinsurance Account in the Consolidated Revenue Fund. Any claims against the supplementary insurance coverage are payable out of the Consolidated Revenue Fund and charged to the Account. There have been no claims against or payments out of the Account since its creation. The balance of the Account as at March 31,2000, is $550,321 (1999 — $548,821).

The supplementary insurance coverage provided by the Government of Canada under the *Nuclear Liability Act*, as of March 31, 2000, is $590,000,000 (1999 — $590,000,000). Insurance coverage, by the Government of Canada, also includes a class of risks excluded as a liability of the principal insurers.

REVENUE AND COST OF OPERATIONS BY ACTIVITY *(FOR THE YEAR ENDED MARCH 31, 2000)*

	2000				1999
	Revenue	**Licences Provided Free of Charge**	**Total Value of Licences and Other Revenue**	**Cost of Operations**	**Cost of Operations**
Regulatory Activities					
Nuclear reactors and heavy water plants	$26,509,783	—	$26,509,783	$29,325,654	$29,058,936
Research reactors	16,200	145,789	161,989	617,421	538,099
Nuclear research and test establishments	3,409,541	—	3,409,541	4,619,380	4,129,296
Uranium mines	2,243,496	—	2,243,496	3,714,769	3,417,106
Nuclear fuel facilities	875,717	—	875,717	1,088,356	1,125,905
Prescribed substances	69,612	11,845	81,457	145,368	187,435
Accelerators	139,143	444,512	583,655	1,206,081	756,047
Radioisotopes	3,358,195	1,818,192	5,176,387	10,404,355	9,297,772
Transportation	153,785	4,399	158,184	278,584	369,475
Waste management and decommissioning	796,614	114,507	911,121	2,524,773	1,774,795
Dosimetry	70,113	28,912	99,025	210,099	185,364
Import/export	—	—	—	489,196	497,430
	37,642,199	2,568,156	40,210,355	54,624,036	51,337,660
Non-Regulatory Activities					
Foreign training	1,985,028	—	1,985,028	1,186,094	849,113
Other	116,941	—	116,941	3,059,053	1,804,295
	2,101,970	—	2,101,970	4,245,147	2,653,408
Total	**$39,744,169**	**$2,568,156**	**$42,312,325**	**$58,869,183**	**$53,991,068**

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Published by Authority of
The Honourable Ralph Goodale, P.C., M.P.
Minister of Natural Resources Canada

© Minister of Public Works and Government Services Canada 2000
Catalogue number CC171-2000E
ISBN 0-662-29346-0

CNSC Catalogue number INFO-9999-1
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